

DARPA Tech '97



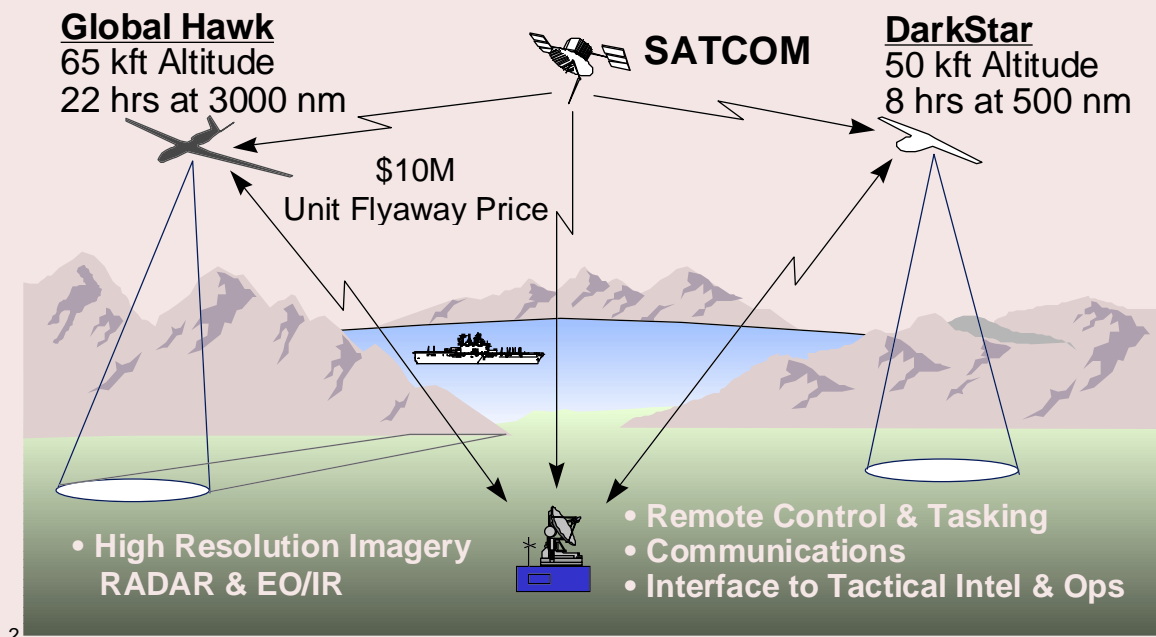
HIGH ALTITUDE ENDURANCE UNMANNED AERIAL VEHICLE

Mr. Charles E. Heber, Jr.
Director, HAE UAV
Program Office



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High Altitude Endurance UAV System



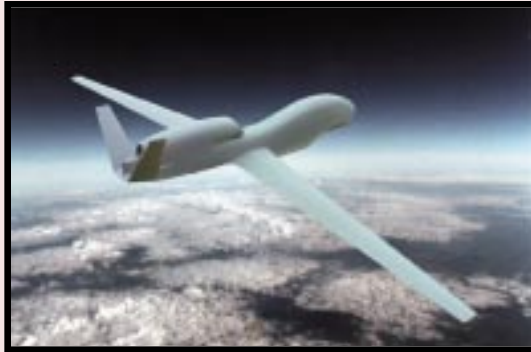
The HAE UAV system is an advanced airborne reconnaissance system comprised of two complementary air platforms, the Tier II Plus Global Hawk and the Tier III Minus DarkStar, and a common mission ground control station. This system is currently under development by the Defense Advanced Research Projects Agency (DARPA) in a Joint Program Office with the Departments of the Air Force, Navy and Army, for the Defense Airborne Reconnaissance Office (DARO). The HAE UAV system addresses several service mission needs validated by the Joint Requirements Oversight Council of the Joint Chiefs of Staff for long range surveillance and broad area coverage imaging capability supporting the theater commander. The Global Hawk vehicle is optimized for supporting low-to-moderate threat, long endurance surveillance missions in which range, endurance and persistent coverage are paramount. The DarkStar vehicle features an incorporation of low observables, or stealth, and is optimized for a moderate endurance, high altitude reconnaissance mission in which ensured, survivable coverage is more important than range and endurance. This dual approach provides a flexible and cost-effective mix of platforms. The current Chairman's Program Assessment, in fact, strongly recommends pursuing both the Global Hawk and DarkStar systems to achieve this mix.

The Common Ground Segment, being developed by E-Systems, combines mission planning, command and control, communications and imagery quality control for both systems into a transportable system housed in two ruggedized shelters.

Global Hawk & DarkStar



Global Hawk



<i>GTW</i>	<i>25,500 lbs</i>
<i>Altitude</i>	<i>65,000 ft</i>
<i>Endurance</i>	<i>22 hrs @ 3,000 nmi</i>
<i>Wingspan</i>	<i>116.2 ft</i>

DarkStar



<i>GTW</i>	<i>8,600 lbs</i>
<i>Altitude</i>	<i>50,000 ft</i>
<i>Endurance</i>	<i>8 hrs @ 500 nmi</i>
<i>Wingspan</i>	<i>69 ft</i>

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The Global Hawk, being developed by an industry team lead by Teledyne Ryan Aeronautical and E-Systems, is considered the “workhorse” of the HAE UAV mix. It is a conventionally designed, wing/body/tail, jet-powered aircraft optimized for payload, range and endurance. It’s a 25,500 pound vehicle capable of operating at 65,000 foot altitude with up to 42 hours of endurance. In terms of physical size, it has an overall wing span of 116 feet and a length of 44 feet. Its overall size is comparable to a U-2. The DarkStar, being developed by an industry team lead by Lockheed Martin Skunk Works and Boeing Military Aircraft, is more of a special purpose aircraft targeted for use in high threat environments prior to the suppression of hostile air defenses. It is a more unconventional design and, as mentioned, is optimized for the incorporation of low observability or stealth for survivability. It has a gross weight of 8,600 pounds, or, about a third that of the Global Hawk and can operate at 50,000 foot altitude for more than 8 hours.

Price as an Independent Variable \$10M UFP (US FY94\$)

- Performance Objectives Stated but Open Trades

Mostly Commercial Practices/Standards

Advanced Concept Tech Demo - Not DoD 5000.1

- Heavy User Involvement
- 24 Months User Operational Field Demonstrations

DARPA Other Agreements Authority

- FARS, DFARS, TINA, CICA Not Mandated

Integrated Product Development

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The HAE UAV system is taking advantage of a number of unique acquisition practices in order to achieve an affordable system solution. First of all, cost is the single requirement for both of these aircraft. The contractors are being driven to a \$10 million UFP requirement and all other system attributes, including performance, are traded off against this requirement. We refer to this as “cost as an independent variable” and the intent is to arrive at a system solution which is not the best we can imagine, but rather good enough to do the job. Secondly, the HAE program is one of the Department’s Advanced Concept Technology Demonstration (ACTD) programs, and, as such, takes advantage of early user involvement in the program to insure that user needs and desires are being addressed, as a way of streamlining the downstream transition of the program into operational use. Our prime customer and user, the United States Atlantic Command (USACOM), is currently working closely with us and the service components to tailor requirements and develop a concept of operations, building upon related work done for the Predator UAV, for ultimately employing these systems in a variety of military roles. In later phases of the program, these users will be directly involved in operational demonstration and evaluation of HAE UAV capabilities, will assess the overall utility to the warfighter, and will provide critical input to production transition decisions to be made near the turn of the century. Thirdly, DARPA is executing the current phase of the program using Section 845 Agreements Authority. This allows tremendous flexibility in how we develop and acquire these systems and provides the mechanism for insuring that we can achieve our \$10 million UFP goal. Finally, we are executing the current phase of the program within an Integrated Product Development (IPD) environment. This has created a unique atmosphere between the government and industry that promotes teamwork and trust and provides complete visibility into program progress.

Operational Concept



**Direct Operational Control and Tasking by Warfighters -
Joint Task Force/Theater CINC**

**Timely Dissemination in Exploitable Form via Line of Sight
Datalink & SATCOM To:**

- Exploitation and Intelligence Support Assets
- Operational Users and Weapons Systems

Long Range with Persistent 24 hr Dwell (Global Hawk)

**All Weather Wide Area and Spot Coverage -Dynamically
Taskable by User**

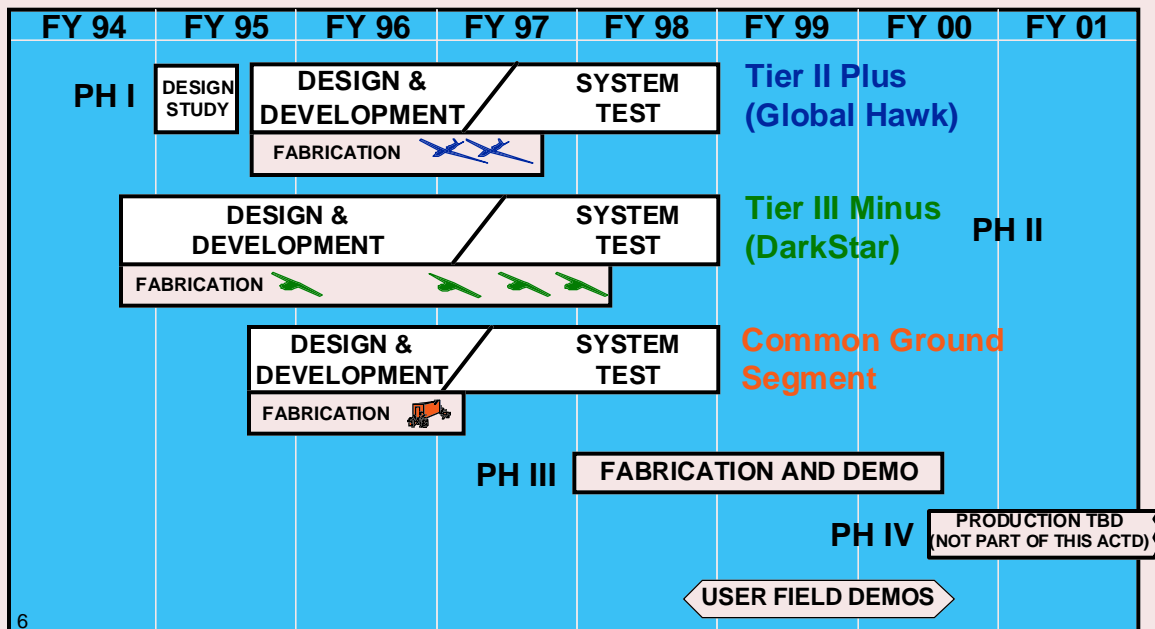
High Quality Imagery with Targeting Accuracy

***“The Right Image, to Right User,
at Right Time, at Right Rate”***

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The HAE UAVs will provide rapid response, world wide coverage for reconnaissance needs under scenarios ranging from pre-crisis conditions, into hostilities and through post-war treaty surveillance. They will be capable of sustained, high altitude, high resolution imagery surveillance and reconnaissance under adverse weather conditions at up to 3,000 nm radius of action. The Global Hawk and DarkStar complement each other by providing wide area search and spot mode capability in high, and low to moderate air defense threat areas. They produce releasable, high resolution imagery, transmitted in near real-time to operational theater commanders. SAR and EO/IR data, transmitted to current and planned image exploitation and dissemination equipment (i.e., CIG/SS, JSIPS/JSIPS-N, CARS, ETRAC, etc.), provides battlefield situational awareness and near real-time intelligence and targeting information. These capabilities provide Joint Force/Joint Force Component Commanders with accurate, timely data on enemy terrain, infrastructure, force concentrations, offensive and defensive positions, and deception postures; and combat assessments necessary for planning theater campaigns and major operations. This potential allows for a rapid targeting cycle to meet the challenges presented by a mobile enemy. The bottom line is that the HAE UAV systems directly provide critical, tactical, wide area reconnaissance/surveillance to the war fighter in peacetime, and in all phases of war and all threat environments.

HAE UAV Schedule (FY)



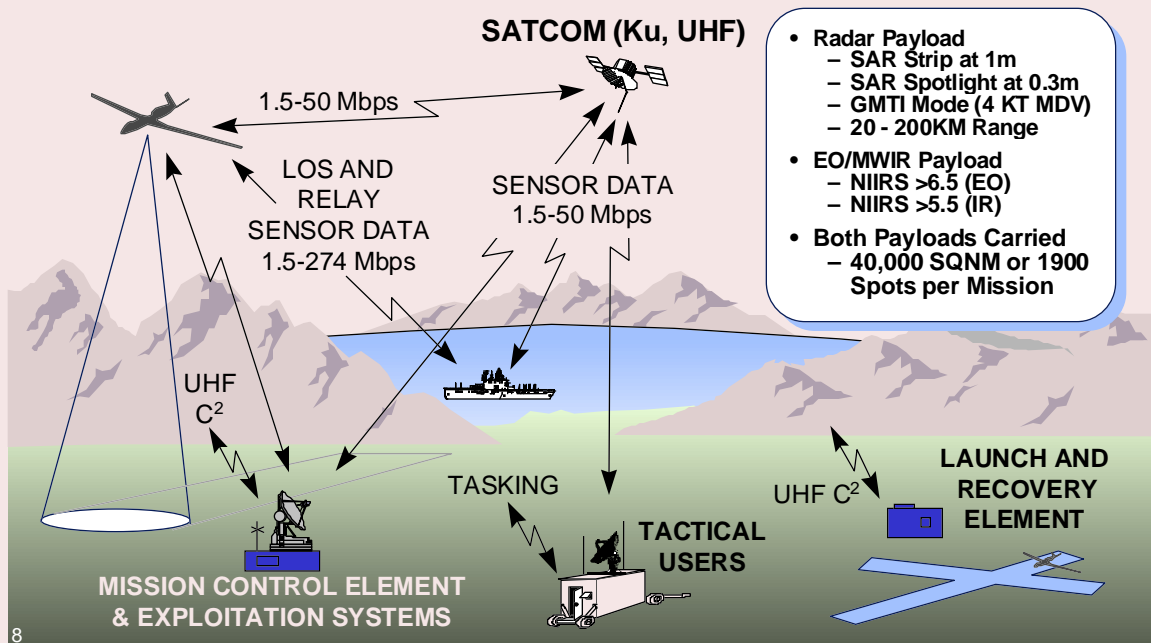
Both the Global Hawk and DarkStar developments are in Phase II of a four phase program. Phase I was the concept definition phase and resulted in the selection of our current contractor teams. Phase II, the current phase, is focused on developing, fabricating and flight testing both systems. The flight testing will include both airworthiness and payload performance testing, as well as some limited field demonstrations. During Phase II, two Global Hawk and four DarkStar vehicles and one common ground station will be built and tested. This phase is currently expected to run through December 1997. Phase III focuses on operational demonstration and user evaluation of the two systems through field demonstrations and military exercises. During this phase, eight additional air vehicles, in a mix to be determined, and two common ground stations will be fabricated. Phase III will run through December 1999. The completion of Phase III will follow a decision to enter into full production in Phase IV.

Tier II Plus Global Hawk



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Conventional HAE UAV Global Hawk



The Conventional HAE UAV Global Hawk will fly at 60-65 KFT altitude and remain 24 hours at a 3000 NM radius range. It will communicate either directly or via satellite with its mission control element, exploitation systems, or suitably equipped tactical users. Its radar will perform wide area surveillance with an accuracy of 1 M. The same radar will be able to focus on a spot target with an accuracy of .3 M, or detect a moving vehicle with a velocity of at least 4 knots. The EO/IR payload will be able to provide imagery >6.5 for EO or >5.5 for IR on the National Imagery Interpretation Rating Scale. Either the radar or EO/IR payloads will be able to image 40,000 SQNM in the wide area mode, or 1900 spots in the spot mode, per day.

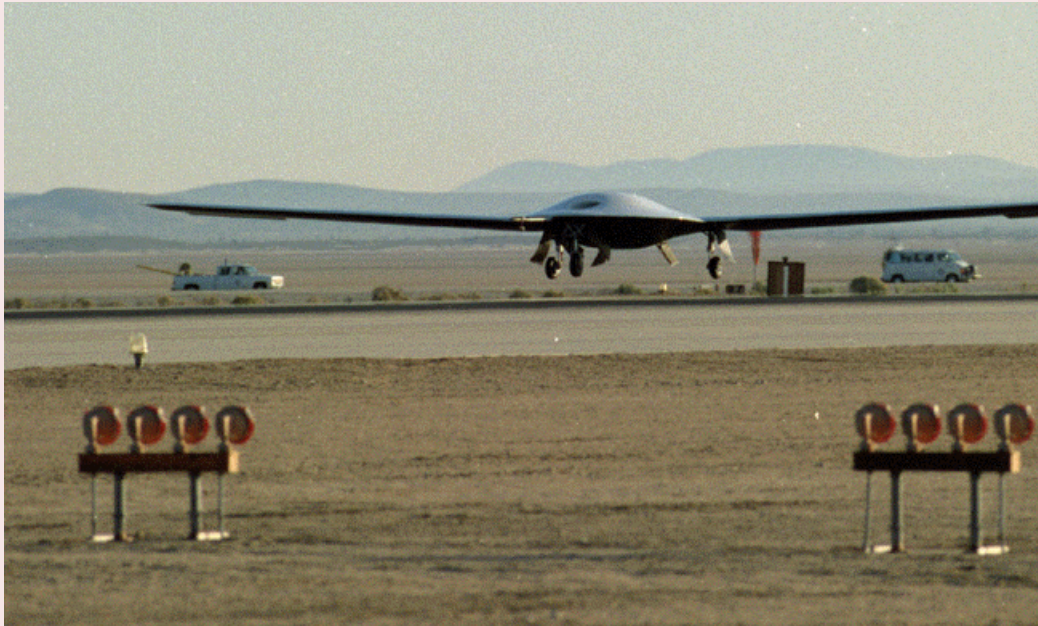
Global Hawk Status



- Completed Air Vehicle System Checks at TRA
- Completed Majority of System Level Communication Tests
- UAV-1 and LRE in Check-out at Edwards AFB
- MCE Scheduled to Ship to TRA - 2nd Week of Sep
- Taxi Testing to Start Next Month
- TRA Authorized to Start Fabrication of Global Hawk 3 & 4, Long Lead for Global Hawk 5, and Associated Engineering - 5 Aug
- SAR Flights on A-3 Scheduled for Late Sep
- 9 Global Hawk First Flight, Late this Year

The Global Hawk has completed all factory tests of air vehicle #1 and is currently undergoing check-out at Edwards AFB in preparation for the initiation of taxi testing next month. First flight of Global Hawk is anticipated late this year. Authorization has been given for the fabrication of the remainder of the Global Hawk ACTD assets.

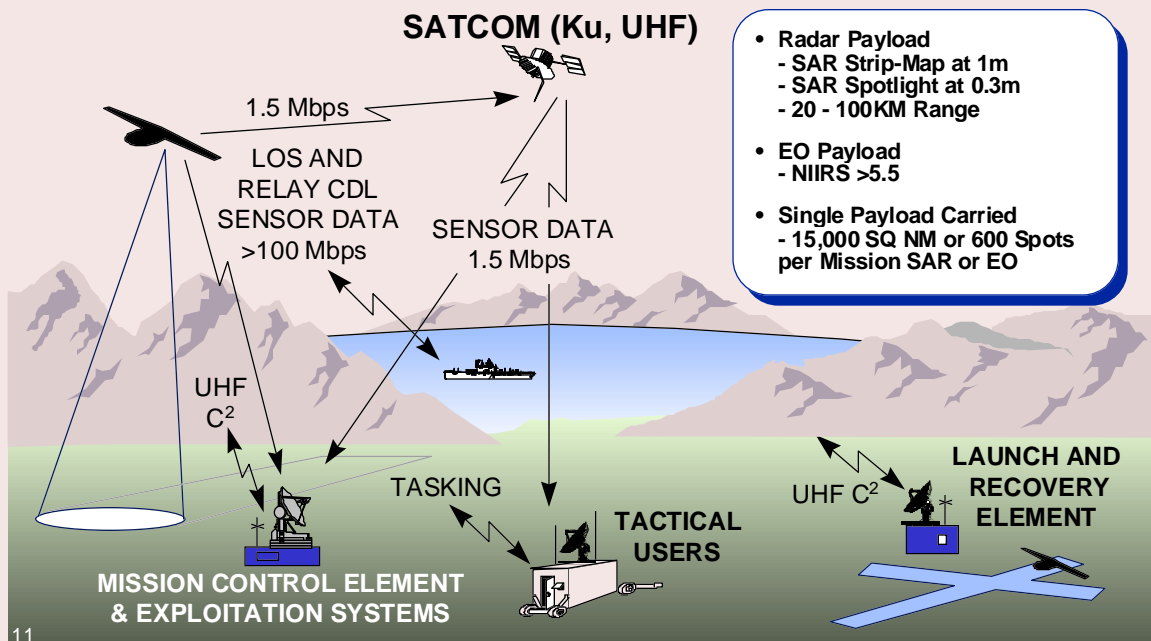
Tier III Minus DarkStar



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The DarkStar program is currently entering a very exciting period in its development. The first two of the four DarkStar air vehicles to be built in the current phase have been fabricated, undergone ground testing, and have started flight testing (29 Mar 1996).

Low Observable HAE UAV DarkStar



The Low Observable HAE UAV DarkStar will fly at >45 KFT altitude and remain >8 hours at a 500 NM radius range. It will communicate either directly or via satellite with its mission control element, exploitation systems, or suitably equipped tactical users. Its radar will perform wide area surveillance with an accuracy of 1 M. That same radar will be able to focus on a spot target with an accuracy of .3 M. As an alternative, the EO payload will be able to provide imagery >5.5 on the National Imagery Interpretation Rating Scale. Either payload will be able to image 15,000 SQNM in the wide area mode, or 600 spots in the spot mode, per day.

DarkStar Status



Air Vehicle #2 is Currently Being Refitted and
Ground Tested at LMSW/Palmdale

System Test Readiness Review - Complete Aug '97

Move to Dryden in Oct '97

Taxi Testing will Begin in Nov '97

Flight Testing will be Late Fall

Air Vehicle #3 & #4 Fabrication and NRE Initiated
May '97

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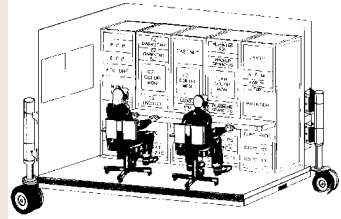
DarkStar air vehicle #2 is currently being refitted at Lockheed's Palmdale, California, facility. Subsystem checkout of the air vehicle will be continuing until October of this year. The system will then be moved to NASA, Dryden Flight Research Center, to begin system testing. Current estimates are to begin taxi testing in late November and flight testing late this fall.

Air vehicles 3 and 4 are now under contract. Delivery of these two systems will be in September 1998 and January 1999, respectively.

HAE UAV's Common Ground Segment



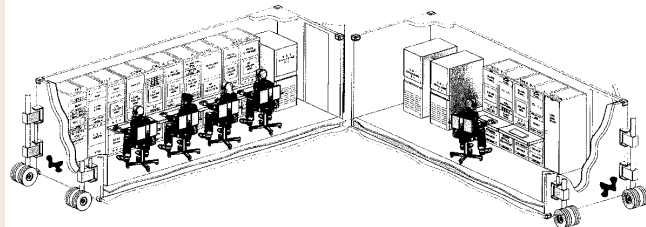
Global Hawk



Launch & Recovery Element (LRE)

- Mission Planning
- Command & Control

DarkStar



Mission Control Element (MCE)

- Communications
- Command & Control
- Mission Planning
- Imagery Operator

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Both the Global Hawk and DarkStar will be operated by a common ground segment developed as an integral part of the HAE UAV program. DarkStar will initially use a limited capability ground segment for initial flight and sensor testing in Phase II until the common ground segment is available in mid-CY-97. This interim segment comprises a Launch Control and Recovery System (LCRS) for mission planning, monitoring, and control and a Processing and Display System (PDS) for image processing and display. The common ground segment for operation of both Global Hawk and DarkStar is being developed in the Global Hawk program. The common ground segment consists of an MCE for mission planning, C2, and image processing and dissemination; and an LRE for controlling launch and recovery; and associated ground support equipment. By designing the ground segment into separate elements, the MCE and LRE can be operated in geographically separated locations. Operations will allow the LRE to be deployed to the UAV operating base while the MCE is forward deployed with the supported command's primary exploitation site, or retained at its main operating base (MOB) to take advantage of existing infrastructure.

Common Ground Segment Status



Global Hawk LRE Supporting Air Vehicle I&T; MCE
Delivery Planned for Sep 97

CGS Agreement Executing; CGS #2 Long Lead
Ordered, Proposal Sep 97

DarkStar Processing Element (DPE) Integrated and
Delivered Aug 97

DPE to Support DarkStar Payload Testing

Common Mission Planning System IDR Aug 97

DarkStar 3/4 Changes, CIP Interface, and IPL
Interface Study Reports Due 31 Aug 97

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Portions of the ground segment supporting initial Global Hawk flights are in place at Edwards AFB. Contracts are in place and work is underway to incorporate DarkStar functionality into Global Hawk LRE and MCE to produce the Common Ground Segment.

New Tier II Plus Payloads



Current Payload Developments Address SAR & EO/IR Imagery Only

New Payloads are Being Studied

- Classified Payload
- Foliage Penetration Radar
- Communication Node

Others May be Considered

- Hyperspectral Sensor
- ???

New Payloads are Not Now Considered as Part of Current ACTD, but as ATDs, New ACTDs, etc

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The Tier II Plus has great potential for carrying a variety of payloads. However, the ACTD focuses on just the Synthetic Aperture Radar (SAR) and Electro-Optical / Infra-Red payloads. Other payloads are being studied by other organizations, and as the Global Hawk capabilities are demonstrated, other applications will be considered. Today, any new payloads are being considered as Advanced Technology Demonstrations (ATDs), or new ACTDs, and are not diluting the HAE UAV ACTD's focus on demonstrating technology for long dwell, high altitude, tactical reconnaissance.

HAE UAV Program Continuing on Fast Track

Development Glitches Always Require
Adjustments; However, There are No
Show Stopping Requirements

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In conclusion, the HAE UAV program is well underway to providing the warfighter and the nation with a new, powerful and much needed capability. Continuing progress over the next few years will demonstrate and define capabilities of the system and ultimately prove the military worth of its implementation in a variety of roles and missions.